THE PRINCIPAL REQUIREMENTS OF THE PORTLAND CEMENT SPECIFICATIONS OF VARIOUS COUNTRIES

COUNTRIES	CHEMICAL REQUIREMENTS							SPECIFIC GRAVITY	FINENESS OF GRINDING			SETTING TIME (VICAT)		SOUNDNESS				MINIMUM STRENGTH (lbs/sq.in)									STANDARD SAND-SIZES IN NEAREST SIEVE Nos.-U.S.STD.S.S.	PACKING
Collection of specifications was begun in 1915, was interrupted by the war, and resumed in 1920. For countries indicated by * there are available no recent reports, but only the replies to first inquiry. Such data is included, although some may now be obsolete.	MAXIMUM PERCENTAGE						MISCELLANEOUS		MINIMUM % PASSING SIEVE	DESCRIPTION OF SIEVE USED - MESH PER UNIT	NEAREST SIEVE IN U.S. STD. SCREEN SCALE	INITIAL - MINIMUM TIME (MINUTES)	FINAL - MIN.-MAX. (HOURS)	P: Pat B: Ball s: Steam b: Boil m: Moist d: Dry				TENSILE				COMPRESSIVE				MISCELLANEOUS M: Machine Moulding c.s.= Combined Storage - 1-day moist air, 6 days water, 21 days air.		MARKING, WEIGHTS, GENERAL NOTES
	INSOLUBLE RESIDUE	IGNITION LOSS	SO_3	MgO	Al_2O_3	ADD. AFTER BURNING								AIR	WATER	ACCELERATED	LE CHATELIER - MAX. EXPANS. mm	NEAT		1:3 MORTAR		NEAT		1:3 MORTAR				
																		DAYS-7	28	7	28	7	28	7	28			
ARGENTINE	a	a	2.0	4		3a	(a) Not over 3% foreign useful material $\frac{CaO}{SiO_2+Al_2O_3+Fe_2O_3}$ = Not less than 1.7	3.05	95 70	30 cm 70	80 170	35	3-10	Pm	P	P Faija	10	427	498 a	171	228 b					(a) Gain 42.7 unless 7-d=568, when 28-d. should show no decrease. (b) Gain=14.2 lbs. M.	14-18	Gross wt., Name, where made, trade mark. Waterproof paper-lined bbls. for Imports.
AUSTRALIA New South Wales - Public Works	2		2.0-b				(b) Total SO_3	3.00	87 75	120 in 180	120 A 170 A	60	3-12	P	P	P Deval Bar. Exp. 0.1%		585 715 ← Deval		165 250 ← Deval	250				2230 3570 c.s.	M.	20-30	Brand on bbls. Dept. seal on bags. Bags=125-lb. net; bbl.=375-lb. net.
Victoria State - Public Works								3.10	90	50 in	50 A	20	2-7	P	P	P s		400	a	150	250 b					2-d. neat=160; 4-d.=250. (a,b) Gains over 7-d strength from 5 to 25%, per sliding scale.		Brand, maker. Bbl.=375-lb. net. Bags=aliquot parts of bbl.
Melbourne & Metropolitan Bd. of Wks.			2.0	3	5-10		Combined SiO_2=20 to 27%. Max. Fe_2O_3=6.0 Lime=58-64; not over 61% unless rotary kiln.	3.00	95 80	50 in 17,000 sq. in.	50 A 120-140 A					P 38° S. or b.		450	c							(c) To exceed 7-d.		Bbl.=375-lb. net, and is unit of purchase. Bags also used.
Melbourne City Council uses British Stds.																												
*AUSTRIA			2.5	5		3	$\frac{CaO}{SiO_2+Al_2O_3+Fe_2O_3}$ = 1.7 minimum	3.10	95 70	30 cm 70	60-70 170	30			P	P d.				171	285 356 cs			1708	2846 3558 cs	28-d. is decisive; 7-d. for control. M.	20-30	bbl.=200-kg. gross; bag=50-kg. 100-kg. is unit of purchase. Mark-Gross wt., name, where made, "Port-C
BELGIUM	1.5	3	2.5	3		a	(a) Plaster only. CaO=61% minimum after calcination.	3.07	95	30 cm	80	45	4-12			P_b	6			185 157 a	285 228 a			1850 1565 a	2846 2277 a	M. (a) Acceptable under special conditions. Comp. test not always required.	20-30	Bbl.=170-Kg. net. Specs. cover packing details.
BRAZIL This is not a standard, but is a railway spec. which is sometimes used	1.5	3	1.5	3			Alkali not over 3%	3.10	97	30 cm	80 A	?	?			B_b												bbls.=140 or 170-kg. net, 150 or 180-gross.
CANADA Spec. used by Dept. of Pub. Wks.			1.75	4				3.10	92 75	100 in 200	100 200	30	1-10	P	P	P s. Warm Water 46°		500	600	200	275	3500	6000	1000	2500	1-day neat=200 lbs. tens; 1500 comp. A.S.T.M. moulding methods. Comp. test optional.	20-30	Brand and maker. Bag.=87½ lb. net.
*CHINA A Railway Specification The Dept. of Public Works at Shanghai, and also at Hong Kong use British Stds.	1.5	2 a	2.75-b	3-b		a	(a) Not over 2% water. (b) Total SO_3. Hydraulic Modulus=2 to 2.85	3.15 3.10 at 4 wks	97 82	76 in 180	70 A 170 A	Rapid 02 Med. 10 Slow 20	1/6-1/2 1/2-2 2-7	After 7-day aeration→5			10	400	a	150	250 a					(a) 28-d. to gain 5% over 7-d. strength	20-30	
*CUBA			2.0	4		3		3.05	90	100 in	100	Gillmore 30-90	10		P	P b.		450	550	140	200 a					A standard hand hammer is used. (a) To gain 10% over 7-d.	20-30	Maker, brand, Dept. of Pub. Wks. insp. stamp. Bbls.=170 kg. net; bags 42.5 to 85 kg. net. Specs. cover details.
DENMARK German specs. also used.						3			97 ?	30 cm 5,000 sq. cm	70 A 170 A	60	2-15		P		10			171 a	228			1708 a	2846	Machine moulding usually; sometimes hand. (a) 7-d for control only.	14-(20-25)	Gr. wt., brand or maker, factory, "Portland Cement." Bbls.=90 or 180-kg. gr., 83 or 170-net; bags approx. 85 net.
ENGLAND	1.5	3	2.75-c	3		b	(a) Total S calc. as SO_3. (b) Water or gypsum only. No slag permitted. After deducting CaO required for SO_3, and calc. by chem. equivalents, $\frac{CaO}{SiO_2+Al_2O_3}$ = 2 to 2.85.		99 86	76 in 180	70 170	20 Rapid 02	10 1/2	After 7-day aeration→5			10	450	a	200	b					(a) = 7-d. + $\frac{40,000}{7\text{-d.}}$ (b) = 7-d. + $\frac{10,000}{7\text{-d.}}$ where "7-d." = 7-day strength. A standard spatula is used in moulding mortars.	20-30	Maker.
FRANCE			3.0-a	5	10	b	(a) No appreciable sulphides. (b) No foreign materials.		90 70	30 cm 70	80 170	20	2-12				10	356	498 a	114	213 b					(a) Gain 42.7-lbs. (b) Gain 28.4-lbs. over 7-d.	10, 14, 18, 35 Three sizes: equal wts. of each size	Maker, net wt. on bbls.; maker on bags. Bags=25 or 50-kg. net.
Special requirements for sea water work →			1.5-a	2-c	8-c	b	(c) Ratio $SiO_2+Al_2O_3$ to $CaO+MgO$=0.47 minimum; variation of 0.02 for each % less Al_2O_3		90	30	80	20	3-12		P-sea water		For Sea Water Work→5											
GERMANY			2.5	5		3	$\frac{CaO}{SiO_2(\text{soluble})+Al_2O_3+Fe_2O_3}$ = 1.7 minimum.		95	30 cm	70	60			P					171				1708	2846 3558 cs	M. 28-d. is decisive test.	14-(20-25)	"Portland Cement," gr. wt., firm or trademark.
*HUNGARY				3		2		3.10?	90 55	30 cm 70	60-70 170	Rapid 10 Slow 30		P	P	B b.				a	228 a				2277	M. or trowel moulding; former preferable. (a) 7-d. and tens. tests for control only.	20-30	"Portland Cement," Gr. wt., factory, address, lead seal on bag with foregoing data. Bbl.=180-kg.; bag=60.
*ITALY		5 a	1.2	3		a	(a) A Govt. R.R. spec. of 1915, which prohibited any inert or injurious materials.	3.05	98 80	30 cm 70	70 170	60	5-12		P	B b.	?			228	285 b			2561	3131 b	(b) 28-d. is decisive test. Values of 228 and 2561 allowed for 28-d. tens. and comp. strength under certain conditions for small lots. M.	14-18	Name and mark of maker.
JAMAICA		2-a	2.0			b	(a) Not over 2% water. (b) Only water or gypsum; of latter, only 2% calc. as SO_3	3.15 3.10 at 4 wks	97 82	76 in 180	70 170			After 7-day aeration→5			10	400	500 b	150	250 a					(a) Gain 20% over 7-d. (b) Gain to be in accordance with sliding scale, 5 to 25%.	20-30	Maker.
JAPAN		5	2.5 (Sea Water Work→1.5)	3		3 a	(a) No addition to cement except gypsum, which is not to exceed 3% by weight.	3.05	90	30 cm	60-70	60	10		P	P b		427 b		142	256 a				1991	Mach. moulding; spatula permitted. (a) Gain over 7-d. (b) If mortar test too long.	20, 30, 35 Equal pts., 2 sizes	
MADAGASCAR General details essentially as for France, except as shown here																		427	498 a	171	256 b					(a) Gain 42.7-lbs. (b) Gain 28.4-lbs. over 7-d.	As for France	Net wt., maker, Bbl.=200-kg. gross. Specifications cover construction of bbls.
MALTA						None			90	50 in	50 A							444										Bbls used. Their construction is described in specifications.
MARTINIQUE			3-a	5	10		(a) No appreciable sulphides.		90 70	30 cm 70	80 A 170 A	20	2-12					356	498 a	114	213 b					(a) Gain 42.7 lbs. (b) Gain 28.4-lbs.		Bbl.
MEXICO	a		1.75	4		3-a	(a) Not over 2% sand or inert material. The following ratio must be complied with $\frac{2.8\times\%SiO_2+1.1\times\%Al_2O_3+0.7\times\%Fe_2O_3}{\%CaO+1.4\times\%MgO}$ = 1 to 1.2	3.05	96 80	100 in 200	100 200	20	2-7	P	P	P b		541	640	157	228					1 d. Neat=199-lbs. Moulding methods approximately the same as in U.S.	20-30	Bbl.=167-kg. net; bag=50-kg. net. Factory, where made.
MOROCCO Used for Govt. work in the French zone. No standard specification is used by the Moorish Govt.									90 70	30 cm 70	80 170	30 05 ← Rapid for Sea Water	3-12 1/6-1/4		P		5	285 356 142	398 a 498 a 228 a	100 114 85	185 b ← For Bldgs. 213 c ← Marine, Slow 171 c ← Marine, Rapid					(a) Gain 42.7-lbs. over 7-d. (b) Gain 42.7-lbs. (c) Gain 28.4-lbs.	As for France	Bbl. or bag.
*NETHERLANDS Army Engineers Reinf. Concrete (Engrs.) Dept. of Water Ways	1.5	3-a 2.2	2.5			a a	(a) No slag.	3.10 3.10	95 70 90	30 cm 70 30	60-70 170 60-70	135 120 / 60 Sea Water 120	10 3	P	P P P	P b.	10	356 356	498 498	199 171 142	285 285 b 228			1708 1423	2846 b	M. (b) Gain:- tensile 10%; compressive 25%.	German Sand?	Maker, pkgs. sealed. Certificate of origin with shipment. Bbl. or bag.
NORWAY	1.5	4	2.5	4		a	(a) Water or gypsum only. $\frac{CaO}{SiO_2+Al_2O_3+Fe_2O_3}$ = 1.7 min.	3.05	96 70	30 cm 5,000 sq. cm.	60-70 170	60	10		P	B b	5			199	285			1992	2846	M. 28-d. is decisive test.	As for Germany	"Portland Cement," factory or trade mark, gross wt. Bbl.=170-kg. net; bag=56⅔ kg. net.
PORTUGAL			2.5-a	3			(a) No appreciable sulphides. Hydraulic Index = 0.42 to 0.50.	3.00	90 70	30 cm 5,000 sq. cm.	70 A 170 A	30	3 12				5	356	498 a	114	213 b		4981		2277	Gains of 28-d. over 7-d.: (a) 57; (b) 42.7-lbs.		
*RUSSIA			1.75	3		2	$\frac{CaO}{SiO_2+Fe_2O_3+Al_2O_3}$ = 1.7 to 2.2.	3.05	90 50	30 cm 70	60-70 170	20	1 12		P	P d.		285	356	85	142				1423	Specs. require certain ratios of comp. to tens. strengths. M. for comp.; hammer for tens.	As for Japan	"Portland Cement," factory, supply number, year made, Bbl.=370-lb. net, approx. 397-gross.
SPAIN	1.5	4-b	2.5-a c	3-a		3	(c) Total S not over 1%. (b) Not over 2% water. (a) SO_3+MgO not over 5%. $\frac{CaO}{SiO_2+Al_2O_3}$ = 1.8 to 2.3. $\frac{SiO_2}{Al_2O_3}$ = 2.5 min.	3.05	97 75	30 cm 70	80 A 170 A	30	4 14	Pm.	P	P				228	285			1992	2561	M. for comp; hammer for tens.	14-18	
SWEDEN			2.5	5		3	$\frac{CaO}{SiO_2+Al_2O_3+Fe_2O_3}$ = 1.7 minimum.		95	30 cm	70	60			P		12			199				1992	3558 cs 2846	Tens. and 7-d. comp. tests not decisive. M.	German Sand	"Portland Cement," factory or trade mark, gross wt. Bbl. or bag used.
SWITZERLAND						4	$\frac{CaO}{SiO_2+Al_2O_3+Fe_2O_3}$ = 1.7 minimum.		98 ?	30 cm 70	60-70 170	60			B P For damp location	B b. Dry location					313				3700	28-d. compressive is decisive test. M.	20-30	Brand and maker, gross wt. on pkgs. other than bags. Bags=50-kg. gross.
SYRIA			1.0														5			171								
TUNISIA For sulphate lands			2.0-a 0.8-a	3 2	15 1.5		(a) No appreciable sulphides. For sulph. lands comb. SiO_2=25% min. Ferrous oxide=1% max.		90 70	30 cm 70	80 170	20	2-12				10 5		498		157						As for France	
UNITED STATES	0.85	4	2.0	5		a	(a) Only gypsum or water.	3.10	78	200 in	200	45 Vicat 60 Gillmore	-10 -10			Ps.				200	300 a					(a) To exceed 7-d. strength.	20-30	Maker and brand. Bbl.=376, bag=94-lb. net.
URUGUAY	a	a	2.0	4		3a	$\frac{CaO}{SiO_2+Al_2O_3+Fe_2O_3}$ = 1.7 minimum. (a) Foreign useful mat'l. not over 3%	3.10	98 85	30 cm 70	80 A 170 A	35	3-10	Pm.	P		10	427	498 a	171	228 b					(a) 42.7-lbs. above 7-d. unless 7-d.=569, when 28-d. must show no decrease. (b) 14.2-lb. above 7-d.	14-18	Imports in waterproof-paper lined bbls., with gross wt., place of origin, maker's mark.

"A" = Approximate No. - Information insufficient for close comparison.

FOLLOWING COUNTRIES USE SPECIFICATIONS DESCRIBED.

*ARABIA - Aden Govt. uses British Specs.
AZORES - Probably Portuguese Specs.
BALLEARIC Is. - A Spanish Spec.
BOLIVIA - Sometimes Argentine
BURMA - Govt. uses British Specs.
CEYLON - British Specs.
CHOSEN - Tests made; details unknown.
EGYPT - Cairo Dept. of Pub. Wks. uses British
FINLAND - No Std. - German specs. used.
FORMOSA - Japanese Specs.
GREECE - No Std; usually German.
GUIANA (BRITISH) - No Std. - Some Depts. use British
*HAITI - No Std; sometimes A.S.T.M.

INDIA - Dept. of Pub. Wks. uses British
INDO-CHINA - French Specs.
IRELAND - British
KENYA COLONY (AFRICA) - British
PALESTINE - British
PARAGUAY - No Std; sometimes Argentine
ROUMANIA - Tests per I.A.T.M.
SANTO DOMINGO, D.R. Pub. Wks. Dept. uses U.S.
SIAM - A Govt. Dept. - British Specs.
SOCIETY Is. - A French Spec.
SOUTH AFRICA - Union Govt. Pub. Wks. - British
TRINIDAD, B.W.I. - British Specs.

NO STD. SPECS.

ALGERIA
BAHAMA
BULGARIA
*CHILE
*COLOMBIA
COSTA RICA
ECUADOR
GUADALOUPE
GUATEMALA

HONDURAS
LIBERIA
NICARAGUA
PANAMA
*PERSIA
PERU
TURKEY
VENEZUELA

Some of these countries use specs. of country from which cement is bought, consider reputation of brand, and sometimes tests are made by them, or for them by another country.

SPECIAL REQUIREMENTS.

APPARENT DENSITY ~ France requires 1100 grams min. wt. per liter for medium and slow cements and 850 for quick. Portugal, Tunisia for wt. per liter require 1000-g. In Australia, Melbourne & Metropolitan Bd. of Wks. requires 116-lb. per struck bushel; Victoria Public Wks. Dept. requires 114-lb. Some countries prescribe the method of filling the measures.

MISCELLANEOUS ~ Some countries have requirements for such properties as color, reputation, packing details, variation and loss in weight, residence of the manufacturer's representative, certificates, and country where made.

GENERAL NOTES.

Any close comparison of the specifications of various countries requires consideration of their respective methods of testing. There will be found much variation in such important details as the following:

SPECIFIC GRAVITY ~ Treatment before test.

FINENESS ~ Measurements of sieve wires and openings, size of sample, method of sieving, point of terminating test.

SETTING TIME ~ Apparatus used, storage of test piece, condition considered as the "set," percentage of water.

SOUNDNESS ~ Test pieces, storage prior to test, rate of raising temperature of accelerated tests, degree and duration of the temperature; interpretation of results; if more than one test, which is decisive.

STRENGTH ~ Moulding and storage of test pieces, their dimensions and shapes, rate of applying load, number of specimens broken at one period, method of computing average strength, increases of strength required in certain intervals.

MIXING ~ Percentage and kind of water, manner and time of mixing, apparatus size of batch.

STORAGE WATER ~ Kind of water, temperature, renewal periods.

STANDARD SANDS ~ Kind, size or sizes, how prepared; if more than one size, what proportions of each.

CHEMICAL REQUIREMENTS ~ Limits of composition for special classes of cements; methods of computing; special ratios to be complied with; such details of analytical methods as are included in some specifications.

U.S. DEPARTMENT OF COMMERCE

BUREAU OF STANDARDS

S.W. STRATTON, DIRECTOR

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JRD